Exercise C: Reflectance Data
Field Phenomics Workshop, Maricopa, Arizona
Monday, March 16, 2015 15:50pm
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Spectral Reflectance Data Analysis (Thorp)

I. Download 'Spectra.csv' from the workshop website.

II. Open the file in Excel or your favorite text editor and understand the contents
   A. Column A: Wavelength in nm
   B. Column B: Percent reflectance of well-watered cotton cultivar 'Monseratt'
   C. Column C: Percent reflectance of water-limited cotton cultivar 'Monseratt'
   D. Column D: Percent reflectance of well-watered cotton cultivar 'Pima-S7'
   E. Column E: Percent reflectance of water-limited cotton cultivar 'Pima-S7'
   F. Column F: Percent reflectance of bare soil
   G. Some wavelengths have been removed due to instrument insensitivity.

III. Plot the data (Spectral reflectance on Y-axis and Wavelength on X-axis)
   A. Do you understand what is shown?
   B. What wavelengths can the human eye detect (visible light)?
   C. Why is soil reflectance higher than vegetation in the visible spectrum?
   D. Why do the vegetative spectra have a small peak at 550 nm?
   E. Why is vegetative reflectance low at 400 nm and 650 nm?
   F. What happens to vegetative reflectance at 730 nm? Why?
   G. What wavelengths are near-infrared radiation?
   H. Why is vegetative reflectance higher than soil reflectance in the near-infrared?
   I. If NDVI = (NIR-RED)/(NIR+RED), what does the index tell us? Why?
   J. What drives the spectrum from 1300 to 2500 nm?
   K. Why is vegetative reflectance less than soil reflectance in this range?
   L. What spectral differences do you see among cultivar and water treatments?

IV. Use the full spectrum data to understand filter options for active sensors
   A. How does vegetation reflect radiation at common filtering wavelengths?
      1. 590 nm?
      2. 650 nm?
      3. 730 nm?
      4. 760 nm?
      5. 800 nm?
   B. How might the band width of an optical filter affect measurements?
   C. How might the selection of optical filters for active sensors affect the NDVI calculation? You may want to calculate NDVI for a few band combinations.

Active sensor data processing (Andrade-Sanchez)

I. Download 'ACS-430_grass-conditions.txt' and 'ACS-430_height-test.txt' from the workshop website.
II. Open Excel → in file, select 'open new file' select 'ACS-430_grass-conditions.txt' → in text import wizard, select 'delimited' then 'next' → select 'comma' then 'next' → select 'finish' → save this file as a spreadsheet with the name 'ACS-430_grass-conditions.xls'

Repeat the process with file 'ACS-430_height-test.txt'

III. Name columns A-E as follows:

Column A: Red edge (720nm)
Column B: NIR (780nm)
Column C: Red (670nm)
Column D: NDRE (Normalized-difference red-edge)
Column E: NDVI (Normalized-difference vegetation index)

IV. Organize data by condition during test:

A. Row correspondence for file 'ACS-430_grass-conditions.xls':
   a. 1 – 1249 = green grass
   b. 1251 – 2511 = stressed grass
   c. 2513 – 3730 = fake grass
   d. 3732 – 4840 = bare soil

B. Row correspondence for file 'ACS-430_height-test.xls'
   a. 1 – 1220 = 48"
   b. 1222 – 2401 = 36"
   c. 2403 – 3586 = 24"
   d. 3588 – 4805 = < 12"

V. Compute mean values and standard deviation for NDVI of all conditions in both tests. Tabulate the results and/or make plots. Follow class discussion on the effects of height and target condition.